# 18-29-603 Water Service.

# 18-29-603.1 Size of water service pipe.

The service pipe is the pipe which conveys the water from the mains of the Chicago Waterworks System to the building, structure, or premises served. Each service pipe shall be of sufficient size to permit the continuous and ample flow of water to supply adequately all floors at any given time. No service pipe of a nominal pipe size less than 1 inch (25 mm) shall be installed in any public way or other public place of the city, nor connected to the mains of the Chicago Waterworks System.

# 18-29-603.1.2 Increased connection required.\*

City connection shall be increased by 2 inches where used to serve both domestic and fire protection demands when the domestic exceeds 2 inches.

# 18-29-604.10.1.2 Size of piping.

The size of piping shall be such that the velocity of each flow during maximum demand will not exceed 8 feet (2440 mm) per second velocity in the main supply pipe, principal supply pipe, and branch supply pipe. When a water service requires a pump, the velocity of flow in the service shall not exceed 5 feet (1525 mm) per second velocity.

## 18-29-604.10.2 Procedures for calculating sizing.

See Appendix A for procedures for sizing of the water supply system.

# Appendix A Procedures for Calculating the Minimum Sizing of the Water Supply System

For a printer-friendly PDF version of Appendix A, please click here.

The following is a procedure that shall be used in calculating the minimum sizing of the water supply system:

- **Step 1.** Compute the total number of fixture units from Table <u>18-29-604.10.1</u>, Demand Weight of Fixtures in Fixture Units.
- 1. For supply outlets likely to impose continuous demands, estimate continuous supply separately and add to total demand for fixtures.
- 2. For fixtures not listed, weights may be assumed by comparing the fixture to a listed one using water in similar quantities and at similar rates.
- 3. The given weights are for total demand. For fixtures with both hot and cold water supplies, the weights for maximum separate demand may be taken as three-fourths the listed demand for supply.

Table 18-29-604.10.1 Demand Weight of Fixtures in Fixture Units

Fixture Type	Occupancy Use	Valve Type	Fixture Units
Water Closet	Public	Flush Valve	10
Water Closet	Public	Flush Tank	5
Urinal 1"	Public	Flush valve	10
Urinal 3/4"	Public	Flush valve	5
Urinal Tank	Public	Flush tank	3
Lavatory	Public	Faucet	2
Bathtub	Public	Faucet	4
Shower head	Public	Mixing valve	4
Service sink	Office, etc.	Faucet	3
Kitchen sink	Hotel or restaurant	Faucet	4
Water closet	Private	Flush valve	6
Water closet	Private	Flush tank	3
Lavatory	Private	Faucet	1
Bathtub	Private	Faucet	2
Shower head	Private	Mixing valve	2
Bathroom group	Private	Flush valve for closet	8
Bathroom group	Private	Flush tank for closet	4
Separate shower 109	Private	Mixing valve	2
Kitchen sink	Private	Faucet	2
Laundry trays (1 to 3)	Private	Faucet	2
Combination fixture	Private	Faucet	3
Laundry washer	Private	Faucet	2
Bidet	Private	Faucet	2
Dishwasher			2
Drinking fountain			1/2

Laundry washer	Public	8 lbs	3
Laundry washer	Public	15 lbs	4
Water closet	Public/Private	Flushometer tank	2

**Step 2.** Using Table 18-29-604.10.2, convert the total water demand from fixture units to gallons per minutes (gpm). Add any continuous supply demand in gpm such as lawn sprinklers, air conditioning, industrial uses, etc., to the sum of the total demand for fixtures. The result is the total required gpm demand. All distributing pipes, riser pipes and branch distributing pipes shall be sized in accordance with the demand indicated in Table 18-29-604.10.2 of this chapter.

Beyond the capacity listed in Table <u>18-29-604.10.2</u>, the service pipe, main supply pipe, principal supply pipe and the branch supply pipe shall be sized to meet the velocity of water flow provisions of this chapter. Data shall be provided by the designer to substantiate this.

Table 18-29-604.10.2 – Part 1 Conversion of Total Water Demand

For Systems Predominantly Flush Tanks		For Systems Predominantly for Flush Valves		
Load Demand		Load	Demand	
1	1.5	1	_	
2	2.5	2		
3	3.3	3		
4	4.0	4	_	
5	4.8	5	15.0	
6	5.5	6	17.5	
7	5.7	7	19.7	
8	6.9	8	22.2	
9	7.5	9	24.5	
10	8.2	10	27.0	
11	8.8	11	27.8	
12	9.5	12	28.5	
13	10.1	13	29.5	
14	10.8	14	30.1	
15	11.4	15	31.0	
16	12.0	16	31.8	

17	12.5	17	32.6
18	13.0	18	33.5
19	13.5	19	34.2
20	14.2	20	35.0
25	17.0	25	38.2
30	19.4	30	41.5
35	21.8	35	43.6
40	24.3	40	46.0
45	26.8	45	48.2
50	29.0	50	50.5

Table 18-29-604.10.2 – Part 2 Demand Weight of Fixtures

For Systems Predominantly for Flush Tanks		For Systems Predominantly for Flush Valves		
Load W.S.F.U.	Demand GPM	Load W.S.F.U.	Demand GPM	
60	32.0	60	54.6	
70	35.0	70	58.7	
80	38.0	80	61.5	
90	41.0	90	65.0	
100	44.0	100	68.0	
120	48.0	120	74.0	
140	53.0	140	78.0	
160	57.0	160	82.0	
180	61.0	180	86.0	
200	65.0	200	90.0	
225	70.0	225 95.0		
250	75.0	250	100.0	
275	80.0	275	102.0	
300	85.0	300	106.0	
400	105.0	400	125.0	
500	124.0	500	142.0	

750	170.0	750	176.0
1000	208.0	1000	208.0
1250	237.0	1250	237.0
1500	262.0	1500	262.0
1750	283.0	1750	283.0
2000	302.0	2000	302.0
2500	337.0	2500	337.0
3000	362.0	3000	362.0
3500	387.0	3500	387.0
4000	412.0	4000	412.0

**Step 3.** Determine the elevation of the highest fixture or group of fixtures or water opening above the city water main or other source of pressure supply. Multiply this elevation in feet by 0.434. The result is the loss in static pressure in pounds per square inch (psi).

- **Step 4.** Compute the size of meter necessary for a total water demand.
- **Step 5.** Compute the pressure loss through the meter. For pressure losses, consult manufacturer's data.
- **Step 6.** Compute the available pressure to overcome friction in the piping system. First compute all losses (see below):
- 1) Subtract the above losses from the minimum service pressure in the water main or other source of supply. The remaining is the available pressure to overcome friction within an upfeed piping system.
- 2) For gravity water tanks, determine the vertical distance between the incoming water service, the minimum tank water line, and the highest fixture or group of fixtures or water opening. To find the available pressure to overcome friction in the downfeed piping system, multiply the distance defined above by 0.434, then subtract the above losses from this pressure. The remaining is the available pressure to overcome friction within the downfeed piping system.
- **Step 7.** Compute the developed length of the basic circuit of piping from the main in the street, the house pump, the outlet side of the pressure-reducing valve or other source of supply pressure to the highest and farthest outlet.

For a gravity water tank, compute the developed length of the basic circuit of the piping from the tank connection to the highest and most remote outlet. Developed length plus 50 percent will approximate the equivalent length run (ELR).

**Step 8.** Compute the pressure factor per 100 feet of developed length. From the above calculations, take the pressure available for friction loss in psi, (Step 6) divide by the equivalent length run (ELR) (Step 7) and multiply by 100 to ascertain the maximum uniform pressure loss for friction in the piping of the basic circuit. (See Table 18-29-604.10.3)

**Step 9.** Knowing the permissible uniform friction loss per 100 feet of pipe and the fixture gpm and all continuous demands in gpm, the diameter of the building service and main supply pipe to the cold and hot water branch or the first branch may be obtained from Table 18-29-604.10.2.

The diameter of pipe on the coordinate point corresponding to the estimated demand and the permissible uniform friction loss shall be the size of the service and main supply pipe to cold and hot water branch or the first branch.

All other piping in the water supply system shall be sized according to the full-listed demand weight, with the exception of piping that supplies fixtures with both cold and hot water, which may be sized at three-fourths of the listed demand weight for cold or hot water piping. All continuous demands on the piping system shall be included in the fixture gpm demand.

For fixtures not listed, demand weights may be assumed by comparing the fixture to a listed one using water in similar quantities and at similar rates.

The cold and hot water principal supply pipe, branches and risers may be obtained from either Table 18-29-604.10.3 or 18-29-604.10.4, whichever is applicable. The diameter of pipe on or directly above the coordinate point corresponding to the estimates\* demand and the permissible uniform friction loss shall be the size of the pipe.

\* Editor's note – As set forth in Coun. J. 3-28-01, p. 55444, § 1; correct language appears to be "estimated".

No service shall be less than 1 inch nominal pipe size. Where 1 inch flushometer valves are used, the minimum size of water service shall be a 1 1/2 inch nominal pipe size and the minimum size of the riser shall be a 1 1/4 inch nominal pipe size. No riser shall be less than 3/4 inch nominal pipe size.

Table 18-29-604.10.3
Allowance in Equivalent Length of Pipe for Friction Loss in Valves and Threaded Fittings

Diameter of Fitting (Inches)		Standard FII	90-DEG Side Tee (Feet)	Coupling or Straight Run of Tee (Feet)	Gate Valve (Feet)	Globe Valve (Feet)	Angle Valve (feet)
3/8	<b>1</b>	0.6	1.5	0.3	0.2	8	4
1/2	2	1.2	3	0.6	0.4	15	8

3/4	2.5	1.5	4	0.8	0.5	20	12
1	3	1.8	5	0.9	0.6	25	15
1 1/4	4	2.4	6	1.2	0.8	35	18
1 1/2	5	3	7	1.5	1.0	45	22
2	7	4	10	2	1.3	55	28
2 1/2	8	5	12	2.5	1.6	65	34
3	10	6	15	3	2	80	40
3 1/2	12	7	18	3.6	2.4	100	50
4	14	8	21	4.0	2.7	125	55
5	17	10	25	5	3.3	140	70
6	20	12	30	6	4	165	80

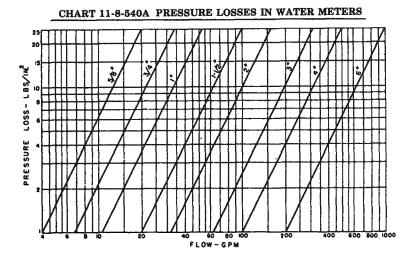
## Size of Water Supply Pipes

29(11-8-530) Each main supply pipe, principal supply pipe, branch supply pipe, riser pipe, distributing pipe, or branch distributing pipe shall be of a size which under normal pressure shall deliver a full volume of water to each and all its outlets.

## Minimum Sizes of Branch Distributing Pipes for Fixtures and Appliances

29(11-8-540) The water supply system shall be designed on the basis of the minimum available pressure at the water main or other source of water supply. The minimum available pressure will be given by the Bureau of Water for each location.

The water supply demand load in the distributing system shall be based upon the number, type, and probable simultaneous use of the the fixtures to be supplied. The size of piping shall be such that the velocity of water flow during maximum demand will not exceed eight (8) fps velocity in riser pipes, branch distributing pipes, distributing pipes and will not exceed ten (10) fps velocity in the service pipe, main supply pipe, principal supply pipe, and branch supply pipe, except that when a water service requires a pump the velocity of flow in the service shall not exceed five (5) fps velocity. The minimum constant pressure at the highest water discharge outlet shall be not less that eight (8) psi for all fixtures except for direct flash-valves, for which it shall not be less than fifteen (15) psi, and except where fixtures or special equipment is used requiring higher pressures. In determining the available pressure to overcome friction in the piping system, head meter and other losses shall be deducted from the minimum available pressure source. When the pressure exceeds eighty (80) psi at any plumbing fixture, the pressure shall be reduced by an approved



#### **Pipes**

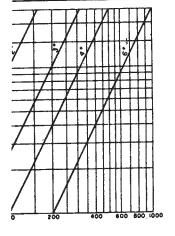
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## s for Fixtures and Appliances

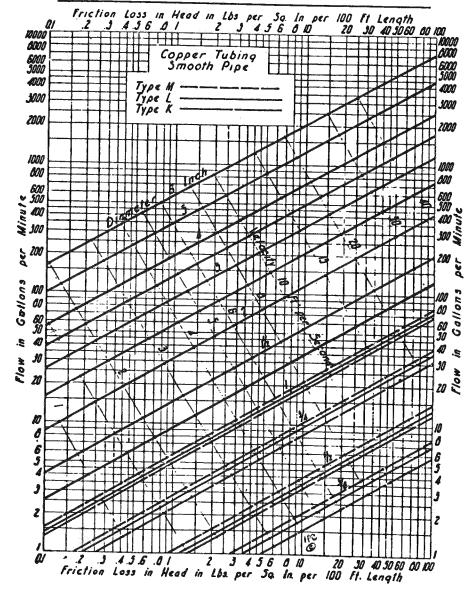
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#### S IN WATER METERS



# CHART 11-8-540B FLOW CHART FOR SMOOTH PIPE



I be made in the presence of a representa-

nstalling contractor.

pacity at its rated pressure. Fire pumps st 150 percent of the rated capacity at 65 intake side of the pump shall not be less

resence of a representative of the bureau

, 31217.)

#### uirements

ler systems shall be taken from one or

icient to supply not less than 25 percent ea served for a period of not less than 20 than 35 feet above the highest sprinkler der shall be calculated as 22 gallons per

l be 10,000 gallons.

not less than 4,500 and not more than l of water and one-third full of air at a ch. Total water capacity of tanks in galink capacity section. The drop from the m the pressure tank at a level at least 35 gravity tank check valve shall be at this

are used.

ain, having a capacity sufficient to supirgest fire area except that no fire pump 00 gallons. Capacity of a fire pump shall a 250 gallons per minute sprinkler fire tion to the city water main may be used ed only as a residential unit which does ich has less than 100 sprinkler heads in kler head shall be calculated as 22 galo provide 18 pounds per square inch at ydraulic design.

m and an inside standpipe system; pro-I to the required capacity for the autol capacity for the standpipe system. It s prescribed for the more severe service. if used to supply both domestic service

service exceeds two inches.

ufficient volume and residual pressure er of sprinklers in the largest fire area to il pressure of 18 pounds per square inch ot utilizing hydraulic design. The dis-. (Amend. Coun. J. 10-30-96, p. 31217.)

## other Services

ed for any purpose except to supply a he system. (Amend. Coun. J. 10-30-96,

of steel; they shall be constructed and F.P.A. Standard 22, Standard for Wa-(Amend. Coun. J. 10-30-96, p. 31217.)

#### Pressure Tanks

9(15-16-300) The materials and construction of tanks under pressure shall be in accordance with the American Society of Mechanical Engineers "Rules for the Construction of Unfired Pressure Vessels", Section VIII, dated 1986.

They shall be installed on steel or reinforced concrete supports, located so as to prevent sagging or vibration in the tanks and so as to distribute the load. Each tank shall be provided with a glass water column installed on one end of the tank at such a height that the center of the gauge glass shall be at the normal level of the water in the tank and equipped with automatic safety cocks. (Amend. Coun. J. 10-30-96, p. 31217.)

Fire Pumps

9(15-16-310) Fire pumps and auxiliary equipment, including controllers required to form complete pumping units, shall be of a type designed and developed for sprinkler service. The installation shall comply with the National Fire Protection Association's Standard 20 entitled "Standard for the Installation of Centrifugal Fire Pumps", 1993 edition. The suction pipe shall be 6" for 500 and 750 gallons per minute pumps and 8" for 1000 and 1500 gallons per minute pumps. The city connection shall be increased 2 inches if used for both domestic consumption and fire protection demands when the domestic service exceeds 2 inches.

In each case the pump used shall be selected to meet the conditions surrounding the installation. The pumping unit shall be designed to develop full capacity at its rated pressure. The design and installation of a pump shall be such that under any flow rate the intake pressure at the pump shall be not less than five pounds per square inch.

A fire pump shall be automatic in operation. A time delay device set for one minute for each 10 horsepower of motor rating but not to exceed 7 minutes shall be provided. A separate automatically controlled centrifugal pressure maintenance pump to avoid too frequent starting and stopping of the fire pump shall be provided. (Amend. Coun. J. 10-30-96, p. 31217.)

#### Test Manifold

9(15-16-311) Each fire pump which supplies an automatic sprinkler system shall be provided with a discharge test manifold having one two and one-half inch corrosion resistant valve for each 250 gallons per minute of rated pumping capacity however no more than six valves need be provided. The discharge test manifold shall be located on an outside wall in a location which will permit safe discharge and drainage of water. (Added Coun. J. 10-30-96, p. 31217.)

### Supply to Tanks

9(15-16-320) A gravity tank used for a sprinkler system shall be supplied with water by a filling pump having a capacity such that the tank can be filled in less than eight hours.

The pressure tanks shall be supplied with water by a filling pump having a capacity such that the tank can be filled in not more than four hours and with air by an air compressor having a capacity of not less than 20 cubic feet of free air per minute if of 7,500 gallon capacity or over and 16 cubic feet of free air per minute if under 7,500 gallon capacity. Where the sprinkler system is equipped with both gravity and pressure tanks, one filling pump may be provided for both. Any storage tank used for fire protection purposes when supplied from the City water system shall conform to the piping provisions governing fill lines and overflow pipes for storage tanks prescribed in Chapter 29(11-8) of this code. (Amend. Coun. J. 10-30-96, p. 31217.)

#### Filling Pipe

9(15-16-330) The filling pipe to the gravity tank of any system shall be not less than two inches in diameter.